

SYLLABUS FOR EXAMINATION FOR THE POST OF
LECTURER - MATHEMATICS
(SANSKRIT EDUCATION)
Paper - II

I. Knowledge of Subject Concerned: Senior Secondary Level.

- 1 **Sets, Relations and Functions** : Different kinds of sets and their basic properties, Relations, types of relations, Different types of real valued functions.
- 2 **Complex Numbers** : Complex numbers and their algebraic properties, polar representation, square root of a complex number, De-Moivre's theorem Inverse trigonometric functions.
- 3 **Vector Algebra** : Vectors and scalars, types of vectors and their algebraic properties, scalar and vector product of two vectors, scalar triple product.
- 4 **Differential calculus** : Limit, continuity and differentiability of algebraic functions, trigonometric functions, exponential functions and logarithmic functions. Derivatives of sum, difference, product and quotient of functions. Derivatives of implicit and explicit functions. Increasing and decreasing functions, Second order derivative.
- 5 **Integral calculus** : Integration of functions by the method of substitution, partial fraction and by parts. Basic properties of definite integrals and their uses, Gamma Integral
- 6 **Differential equations** : Order and degree of a differential equation, solution of differential equations of first order and first degree.
- 7 **Permutations and combinations** : Derivation of formulae, their connections and simple applications.
Binomial theorem : Binomial theorem for positive integral indices, general and middle terms in binomial expansion.
- 8 **Matrices** : Various types of matrices, their basic operations and properties. Invertible matrices and their inverse.
Determinants : Determinant of a square matrix and their properties. Solution of system of linear equations in two or three variables using inverse of a matrix.
- 9 **Two dimensional geometry** : Cartesian and Polar coordinates, Conic Sections: Axes, Focii, Directrix, Eccentricity of a Conic, Polar equations of a Conic, Straight line, standard equations and simple properties of circle, parabola, ellipse, hyperbola.
- 10 **Applications of derivatives and integrals** : Tangent and normals, maxima and minima of functions of one variable. Area under simple curves, area between the simple curves.
- 11 **Statistics**: Measures of Central tendency, Mean, Mode, Median for ungrouped and grouped data, measure of dispersion and Standard deviation. Probability and their elementary laws, conditional probability.

II. Knowledge of Subject Concerned: Graduation Level.

- 1 **Group Theory** : Groups and their simple properties, order of an element, order of a group, permutation groups, cyclic groups and their properties, subgroups and their basic algebraic properties, cosets and their properties.
- 2 **Normal subgroups and Rings** : Normal subgroups and quotient groups, theorems on homomorphism and isomorphism.
Rings, ideals, integral domain and fields.
- 3 **Theory of equations** : Relation between the roots and coefficients of general polynomial equation in one variable. Transformation of equations. Descartes' rule of signs, solution of cubic equations by Cardon's method, Biquadratic equations by Ferari's method.
- 4 **Calculus** : Partial derivatives, curvature, asymptotes, envelopes and evolutes, maxima and minima of functions upto two variables, Beta and Gamma functions, double and triple integrals.
- 5 **Real Analysis** : Mean value theorems (Rolle's, Lagrange's, Taylor's theorems), Riemann Integrals, Sequence and Series with convergence properties.
- 6 **Complex Analysis** : Continuity and differentiability of complex functions, Analytic functions, Cauchy – Riemman equation, Harmonic functions. Conformal mappings, Complex Integration, Cauchy Integral Formula.
- 7 **Ordinary and Partial differential equations** : Linear differential equations of first order and higher degree, Clairaut's form, Linear differential equations of constant coefficients, ordinary homogeneous differential equations, Linear differential equations of second order with variable coefficients. Partial differential equations of first order, solution by Lagrange's method, Standard forms and Charpit's Method.
- 8 **Vector calculus** : Gradient, divergence and curl, identities related to them. Line, surface and volume integrals. Applications of Gauss, Stoke's and Green's theorems.
- 9 **Three dimensional geometry** : Direction ratios and cosines, straight line, plane, sphere, cone and cylinder.
- 10 **Statics** : Equilibrium of co-planner forces, moments, friction, virtual work catenary.
- 11 **Dynamics** : Velocities and acceleration along radial and transverse directions and along tangential and normal directions, simple harmonic motion, Rectilinear motion under variable laws, Hook's law and problems, projectiles.

III. Knowledge of Subject Concerned: Post Graduation Level.

- 1 **Linear Algebra and Metric Space** : Vector spaces, linear dependence and independence, bases, dimensions, linear transformations, matrix representation, Eigen values and Eigen vectors, Cayley – Hamilton theorem.

- Metric Spaces :** Bounded and unbounded metric spaces. Open and closed sets in a metric space, Cantor's ternary set, closure, bases, product spaces.
- 2 **Integral transforms and special functions :** Hyper-geometric functions, Legendre's polynomials, Bessel's functions. Recurrence relations and orthogonal properties.
Laplace transform, inverse Laplace transform. Fourier sine and cosine transforms. Convolution theorem.
- 3 **Differential Geometry and Tensors :** Curves in spaces, Curvature, Torsion, Skew curvature, Serret - Frenet formulae. Helices Osculating circle and sphere. Types of tensors and their algebraic properties. Christoffel's symbols, covariant and contravariant differentiation, Geodesics.
- 4 **Numerical Analysis :** Finite difference operators, Newton's formula for forward and backward interpolation for equal intervals, Divided difference, Newton's Lagrange's, Starling's and Bessel's interpolation formulae.
- 5 **Statistics and Optimization Technique's :** Mathematical Expectations, Discrete and Continuous distributions, Binomial, Poisson and Normal distributions. Convex set and its properties. Solution of a L.P.P. by using Simplex methods. Duality, Assignment, Transportation and Game theory.

IV. (Educational Psychology, Pedagogy, Teaching Learning Material, Use of computers and Information Technology in Teaching Learning)

1. Importance of Psychology in Teaching-Learning :
 - Learner,
 - Teacher,
 - Teaching-learning process,
 - School effectiveness.
2. Development of Learner
 - Cognitive, Physical, Social, Emotional and Moral development patterns and characteristics among adolescent learner.
3. Teaching – Learning :
 - Concept, Behavioural, Cognitive and constructivist principles of learning and its implication for senior secondary students.
 - Learning characteristics of adolescent and its implication for teaching.
4. Managing Adolescent Learner :
 - Concept of mental health and adjustment problems.
 - Emotional Intelligence and its implication for mental health of adolescent.
 - Use of guidance techniques for nurturing mental health of adolescent.

5. Instructional Strategies for Adolescent Learner :

- Communication skills and its use.
- Preparation and use of teaching-learning material during teaching.
- Different teaching approaches :
Teaching models- Advance organizer, Scientific enquiry, Information, processing, cooperative learning.
- Constructivist principles based Teaching.

6. ICT Pedagogy Integration :

- Concept of ICT.
- Concept of hardware and software.
- System approach to instruction.
- Computer assisted learning.
- Computer aided instruction.
- Factors facilitating ICT pedagogy integration.

Paper – II Subject Concerned

Duration : 3 Hour

S.No.	Subject	No. of Questions	Total Marks
1	Knowledge of Subject Concerned : Senior Secondary Level	55	110
2	Knowledge of Subject Concerned : Graduation Level	55	110
3	Knowledge of Subject Concerned : Post Graduation Level	10	20
4	Educational Psychology, Pedagogy, Teaching Learning Material, Use of Computers and Information Technology in Teaching Learning.	30	60
Total		150	300

Note : 1. All the question in the Paper shall be Multiple Choice Type Question.

2. Negative marking shall be applicable in the evaluation of answers. For every wrong answer one-third of the marks prescribed for that particular question shall be deducted.
Explanation : Wrong answer shall mean an incorrect answer or multiple answer.